BALTIMORE AND POTOMAC INTERLOCKING TOWER HAER No. MD-163
Adjacent to AMTRAK railroad tracks in block
bounded by Howard Street, the Jones Falls Expressway
Maryland Avenue, and Falls. Road
City of Baltimore
Baltimore ~~County~~ City
Maryland

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
Northeast Region
Philadelphia Support Office
U.S Custom House
200 Chestnut Street
Philadelphia, P.A. 19106

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Location: Adjacent to AMTRAK railroad tracks in block bounded by Howard Street, the Jones Falls Expressway, Maryland Avenue, and Falls Road, City of Baltimore, Baltimore ~~County~~ City, Maryland

UTM: 18.361580.4352100
Quad: Baltimore East, Maryland

Date of Construction: 1911

Builder: Pennsylvania Railroad Company, Philadelphia, Pennsylvania

Present Owner: National Railroad Passenger Corporation (AMTRAK)
Suburban Station Building
1617 John F. Kennedy Boulevard
Philadelphia, Pennsylvania 19103

Present Use: Not in use for railroad signal operations; use ended in 1985

Significance: The tower is part of the Baltimore's Pennsylvania Station terminal complex, which represented the peak of the Pennsylvania Railroad Company's development in Baltimore. The tower's design, construction, and associated machinery are representative of railroad engineering practices and interlocking signal technology in the early twentieth century.

Project Information: Removal of the Baltimore & Potomac (B&P) Interlocking Tower is to be funded by the Maryland Mass Transit Administration (MTA). This documentation was undertaken from July 1993 through July 1994 as a mitigation measure prior to the removal of the tower.

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Baltimore, Maryland
for the Maryland Mass Transit Administration (MTA)

The Baltimore & Potomac (B&P) Interlocking Tower, located in central Baltimore on the Amtrak corridor in the block bounded by Howard Street, the Jones Falls Expressway, Maryland Avenue, and Falls Road, is 1,200' northwest of Pennsylvania Station. The principal (northeast) facade of the building faces the railroad tracks which extend from the southeast to the northwest. It is a two-story rectangular building, measuring 38' x 21'. Supported by stretcher-bond brick foundations, the first story is constructed of poured concrete, the second story of frame. A water table extends around the stuccoed first story. A band of wide *cyma recta* and flat molding separates the first and second stories. The first story features an entrance covered by a tiled shed roof on the northwest facade; a poured concrete stoop with slate and concrete treads and stringer caps rises to the door. There is a basement entrance on the southwest facade. Also on the southeast facade is a second-story entrance reached by a metal stairway. Paired, double-hung sash windows are found on the southeast and southwest facades. The second story consists of a continuous line of vertical windows on all facades; the boarded-up (one over one, double-hung sash) windows are separated by copper-covered decorative pilasters. The Spanish tile roof features flared, deep eaves to protect the second-story windows from rain and glare; under the eaves are exposed notched rafters that rest on plates which are supported by brackets with carved, Craftsman-style dentil bits and triangular knee bracing. A centered rectangular bay projects from the second story of the principal (northeast) facade. The bay has its own roof that connects to the flared, hipped tile roof of the building. The shed roof covering the northwest entrance features exposed rafters that rest on a plate which is supported by brackets. The eave brackets and rafter ends of the bay and northwest entrance duplicate those seen in the main roof. A band of scalloped iron fretwork extends along the ridge line. An exterior chimney on the southwest facade extends through the overhanging eave of the roof.

The basement and first story consist of single rooms. Currently, the basement contains a workbench, furnace, and conduits leading from the first story to the exterior; the first story contains metal racks containing electrical relays and wiring. The second story is dominated by the 25'-long console (stripped of its operating levers) of an interlocking machine and a track board above it. The third floor features a small lavatory in the northwest corner and contains incidental furniture.

The B&P Interlocking Tower is a modest example of Craftsman style construction. More commonly seen in domestic dwellings, the Craftsman style originated in California with the work of the Greene brothers - Charles Sumner Greene and Henry Mather Greene. The style was popular from the early years of the twentieth century to about 1930. Craftsman style features of the B&P Interlocking Tower include the deep roof eaves and elaborate carved brackets and rafter ends which attest to the importance of craftsmanship; the flared roof form which adds an Oriental note, and the continuous band of second story windows and use of stucco on the first story.

Built early in the twentieth century by the Pennsylvania Railroad Company (PRR), the B&P tower was one of two nearly identical primary interlocking towers flanking Pennsylvania Station (the other being the Union Interlocking Tower, see HAER No. MD-50). These towers

provided shelter for personnel and equipment that regulated the movement of trains in the vicinity of Pennsylvania Station. The B&P Interlocking Tower is located southeast of the 1.5-mile-long, double-tracked B&P tunnel that leads to points south of Baltimore; the Union Interlocking Tower was located northwest of the portals of the three-tracked Union tunnels that lead to points north. The Union tower regulated all rail traffic entering or leaving the station through the Union tunnels and north to Bayview. The B&P tower performed the equivalent function for the tracks from the station through the B&P Tunnel and south to Fulton Junction. Ensuring that all rail traffic on this heavily used corridor was correctly routed and that a proper interval between trains was maintained was a serious responsibility for the personnel that worked in the towers; in one four-hour period in 1937, sixty-six trains moved through the Pennsylvania Station complex.

The B&P Interlocking Tower was built as a facet of the PRR's effort to improve and expand its rail facilities in Baltimore in the late nineteenth and early twentieth centuries. By expediting the routing of rail traffic through the maze of tracks leading to Pennsylvania Station, the B&P Interlocking Tower and its predecessors contributed to the effectiveness of the Baltimore section of the PRR's route from Washington, D.C. to New York City. The history of this route through Baltimore provides a context for understanding the significance of the B&P Interlocking Tower.

Founded in 1846 under the presidency of Samuel Merrick, the PRR aggressively pursued a policy of expansion in the years between its founding and the Civil War, and as a result, became one of the most important railroads in the nation. In the eastern United States, the PRR found itself in direct competition with another railroad giant, the Baltimore and Ohio Railroad (B&O), headquartered in Baltimore less than one hundred miles south of the PRR's Philadelphia headquarters.

Competition between the two railroads centered on the ambition of both to develop their own routes connecting New York, Philadelphia, Baltimore, and Washington through the area now known as the "northeast corridor." Initially, reality fell far short of both railroads' ambitions. The B&O had built in 1835 a line from Baltimore to Washington and enjoyed a state-guaranteed monopoly on the route, which was Washington's only rail link with the north. Despite this route and its expansion into the Midwest, the B&O had no tracks north of Baltimore. Prior to 1865, the PRR, like the B&O, had directed its energies to the west and had little presence in the corridor. However, Baltimore was connected, albeit circuitously, with Philadelphia, Wilmington, and New York by a network of small, independent railroads.

After the Civil War, the PRR began to utilize some of these smaller railroads to gain access to Baltimore. In particular, the PRR successfully dominated the Northern Central Railway (NC), which ran from Harrisburg, Pennsylvania (connecting with the PRR in 1855) to Baltimore. By 1861 the NC Board of Directors initiated a period of harmonious cooperation with the PRR, which was to prove advantageous to the PRR in gaining access to Baltimore. The rivalry between the PRR and the B&O was so intense that the B&O refused to allow PRR trains to use its tracks to Washington, so there was, for the time being, no way for the PRR to run its trains to the nation's capital. Additionally, the B&O, well aware

of the arrangement between the PRR and the NC, periodically refused to allow NC passenger and freight traffic on B&O tracks between Washington and NC/PRR points in Baltimore.

The NC was in good financial shape at the end of the Civil War; substantial earnings during the war years allowed the NC to double track the line from Baltimore to York and make rolling stock improvements. Nevertheless, the NC's Baltimore terminal facilities were limited to those that it had in 1850: the City Dock, Fells Point, and a depot at Bayview beyond the eastern limit of the city. NC attempts to build an extension to the docks at Canton were frustrated by right of way acquisition difficulties brought about by Baltimore citizens profoundly sympathetic to B&O hegemony in the city. In 1866 the Union Railroad Company of Baltimore was chartered to construct a toll line to connect Baltimore's industrial center of Canton with Bayview, the NC terminal. Financial difficulties and litigation, however, delayed the construction of the line, and the NC's connection with Canton until the early 1870s.

Harmonious relations between the PRR and the NC gave the PRR access to Baltimore, but a final piece of the puzzle had to fall in place before the PRR could bypass the B&O's state-guaranteed monopoly and run its trains to Washington. That other piece was the Baltimore and Potomac Railroad (B&P), a line chartered in 1853 by the Maryland General Assembly to lay tracks from Baltimore to a point in southern Maryland not far south of the St. Mary's River. Designed to serve the needs of agrarian southern Maryland, by 1858, the B&P route was planned from just south of the Patapsco River to Pope's Creek, Maryland, where it would connect with the Virginia Central Railroad.

Construction of the B&P line in the vicinity of Upper Marlboro was accomplished in 1861, but the Civil War interrupted attempts to complete the line. At war's end, the B&P sought assistance from the B&O, but received no help. PRR officials, however, noted with interest that the 1853 charter allowed the B&P to build lateral branches "not to exceed 20 miles in length" in order to reach various towns in the vicinity of its main line. Such a provision was often included in charters as a means of compensation to towns that had supported the construction of a railroad but found themselves bypassed by the main line.

The PRR officials quickly saw that, with PRR aid, the B&P main line could be built through Bowie, and a "lateral" branch line of less than twenty miles could be extended into Washington; finally giving the PRR access to the nation's capital. In 1866, the B&P was purchased by George W. Cass, a director of the PRR between 1859 and 1865 and President of the Pittsburgh, Fort Wayne & Chicago Railway. The next year, PRR president J. Edgar Thomsen and NC president J. Donald Cameron each purchased $400,000 of B&P securities, ample funding for the B&P to begin construction in earnest. By the end of 1868 thirty-five miles had been graded. In the same year, the commissioners of Charles County purchased $175,000 of B&P stock with money provided by the state for the promotion of internal improvements. In 1869 Oden Bowie, President of the B&P, was elected governor of Maryland. Bowie was instrumental in overcoming B&O supporters in the legislature and securing amendments that permitted construction of B&P tracks.

Determined opposition to the B&P project was offered by B&O supporters in the Baltimore City Council and also in Congress. Great opposition arose to the projected construction of a major tunnel that would bring the B&P not just to the Patapsco River, but to the very heart of Baltimore, where the B&P would connect with the NC and provide the PRR with its long-awaited route to Washington. The B&O opposition was overcome, and in 1869 Congress permitted the PRR to build tracks within the District of Columbia. Construction of the B&P's Baltimore Tunnel (thereafter known as the B&P Tunnel) began in 1871.

The double-track B&P tunnel from Fulton Avenue to the Jones Falls Valley at North Avenue was designed by Thomas Seabrook and built by Thomas Rutter, a New York tunnel builder. The tunnel, 7,499' in length from portal to portal, actually consisted of three tunnels that featured two city-block-long intermediate openings. Most (5,889') of the tunnel was constructed by excavating a trench in which the tunnel structure was built; the top of the trench was then filled in with earth to restore the original ground level. The remaining 1,064' of the tunnel were excavated and lined in order to minimize damage to buildings and streets. Excavation of the tunnel began on June 1, 1871, and over the next two years the construction of the tunnel required between 500 and 700 stonecutters, stone masons, brick layers, timber men, miners, rock men, blacksmiths, machinists, carpenters and common laborers. A total of 13 million bricks were used to construct the interior; Cockeysville marble was used for the facade of the portal and local blue stone for the wing walls. When the tunnel opened on June 29, 1873, The Baltimore American (which had supported the B&P project from the beginning) dubbed it "one of the greatest undertakings that has ever been undertaken in the country and certainly the greatest single enterprise that has ever been successfully carried out in the city."

With the B&P Tunnel completed, the PRR immediately established through service between New York and Washington; the route proceeded from New York to Philadelphia, then to Columbia, Pennsylvania, on to York, over the NC's tracks to Baltimore, and then via the B&P to Washington. Concurrently, however, the PRR planned a new route, with another major tunnel, to supplant the circuitous NC route. One month before the beginning of work on the B&P Tunnel, construction of the Union Tunnel in Baltimore was initiated. The Union Tunnel became another essential link in establishment of the PRR route through Baltimore. Built by the Union Railroad in order to connect Canton yards and tidewater terminals with the NC, the tunnel was begun in May 1871 and extended 3,405' from Greenmount Avenue east to Bond Street. Most of the tunnel was constructed with the cut-and-cover technique but a short portion was "driven", using a steam bore method. Built at a cost of $2.3 million, the tunnel's construction gave employment to 300 men by the time of its completion July 24, 1873. An article on the B&P and Union tunnels in the July 26, 1873 issue of Railroad and Mining Journal enthusiastically claimed "In no other city except London is there so grand a connecting system of railway intercommunication underground. There is no knowing where the influence of the Baltimore tunnels will begin or end."

The Union Tunnel gave the PRR a new and more direct route from Baltimore to Philadelphia. As soon as it was completed, the PRR shifted its through service to this new

line, owned by the Philadelphia, Wilmington and Baltimore Railroad (PW&B), which neutrally handled both PRR and the B&O traffic to Philadelphia. The new route shaved fifty-five minutes off the Washington-New York time via the NC's circuitous detour through Columbia and York. PRR travel time from Washington to New York was now eight hours.

With its new Baltimore and Washington links established, the PRR needed a proper terminal in Baltimore. Located on Charles Street between the B&P and Union tunnels, Union Station was built in 1871 to handle the increased traffic brought by the Union Railroad, the B&P, the NC, and the PRR. Upon the establishment of the PRR's route from Washington and New York, Union Station became the primary PRR passenger depot in Baltimore. With the completion of the Baltimore tunnels and Union Station, the PRR and its allies had gained access to Washington, an efficient route through Baltimore, a serviceable central depot, connections to the Canton docks, and a clear route (via the PW&B) to Wilmington, Philadelphia, and New York. By 1873 the PRR had won a clear victory over the B&O, which was still unable to route traffic efficiently to New York. No doubt the victory was made even sweeter because the main battles had been won in Baltimore, the home city of the B&O.

By 1880, the PRR was reaping substantial profits from its dominance of the northeast corridor. Subsequent actions guaranteed PRR domination of the old PW&B route to Philadelphia and PRR use of the Union Railway in the industrial and shipping district of Canton. Threatening to build a competing railroad, the PRR-dominated NC succeeded in purchasing the Union Railway from its owner, the Canton Company, in 1882, thereby deriving full benefit from the increased business at the docks. The growing commercial interests of the PRR in Baltimore were dispersed among several agents until 1883, when all PRR facilities were placed under the jurisdiction of a general agent. In 1885, a replacement of the first Union Station was undertaken by the PRR. The first station had proved insufficient despite many alterations, including an 1881 enlargement and remodelling of waiting rooms and the introduction of electric lights in the train sheds. On April 1, 1886 the commodious (60' x 200') replacement of brick and granite was opened to the public. On the first floor were waiting rooms and a restaurant; the second floor, level with the street, contained administrative offices and relaxation areas for the trainmen.

The rapid growth of terminal facilities and PRR tracks in Baltimore demanded precise control of train movements. An 1891 article in Railway World described the impressive facilities of the PRR in Baltimore. Special praise was reserved for the railway yard west of Union Station, the site of the present B&P tower: it was "...the best freight yard, it is said, in the entire Pennsylvania Railroad system." The installation of a state-of-the-art interlocking machine at B&P tower (a predecessor to the current structure) in 1891 may have been one of the reasons that this yard was so highly regarded. Such a machine served both to expedite the movement of traffic through the yard and the tracks approaching Union Station and also to guarantee the safety of trains as they crossed the numerous switches that directed them to their destinations. Installation of such a machine had become essential to the quick, efficient and safe operation of the increasingly busy facilities in the vicinity of Union Station. Apparently the rail traffic in the area continued increasing in volume; an enlarged interlocking machine was put into service only four years later, in 1895.

The importance of signalling and switch control to the efficient and safe operation of a railroad cannot be overstated. Reliable signals are necessary for both train crews and drivers of road vehicles who encounter trains at grade crossings. The increasing number of trains and complexity of track layouts toward the end of the nineteenth century necessitated increasing control of the numerous switches that large railway yards and terminals required. When the earliest trains proceeded down the tracks at thirty miles per hour, there was already concern about the safety of those who unwittingly encountered them at grade crossings; but when trains moved at twice that speed, and even faster, the situation became critical. Even after the invention of effective signaling machinery and procedures, thousands of people died each year. Ten thousand Americans died per year in train accidents between 1900-1905. Of these, trains colliding with trains accounted for 3,000 deaths per year. Automatic block signalling and the allied technology of the interlocking track control were critical to reduction, if not prevention, of such deaths.

The PRR was not alone in recognizing the need for effective signalling in the nineteenth century, but it was a pioneer in the development and implementation of automatic block signalling in the United States. An automatic block system was defined by the PRR rule book as "a series of consecutive blocks, governed by block signals, operated by electric, pneumatic or other agency actuated by a train, or certain conditions affecting the use of a block." A block was a length of track of defined limits, the use of which by trains was governed by block signals. In 1879, the PRR placed H.F. Cox (of the PRR Motive Power Department) in charge of signal work. Building on the 1873 discovery that track could be used as an electrical circuit, Cox was responsible for the first American installation of an automatic block signalling system on the east slope of the Appalachians between Altoona and Gallitzin in 1881. From 1906 to 1912 the PRR engaged in a major project to convert the signals to automatics on the New York to Washington route.

Before the invention of interlocking machines, switching was accomplished manually at the switch site; each switch had to be operated individually and by main force. Understandably, mistakes occurred, often with tragic results. Even when all went well, the individual operation of switches required time, and saving time was a constant preoccupation for railroads. Interlocking expedited train movements even as it provided increased safety to train operations. Interlocking was defined by the American Railroad Association as "an arrangement of switches, lock and signal appliances, so interconnected or interlocked that one [train] movement must succeed another in a predetermined order." Interlocking required a tower where all ground operations could be observed and from which all switch movements and signals could be controlled.

The first mechanical interlocking system was invented in England by John Saxby in 1856. His invention proved so successful that it was eagerly taken up by the railroads of his country. By 1873, there were 13,000 interlocking levers (each lever controlling two or three switches) in use on a single British line. Most of these interlocking machines were manufactured by Saxby's firm, Saxby and Farmer, which soon established a factory in the United States. The PRR was quick to notice this important development; one of the first interlocking machines (purchased from Saxby and Farmer) in the United States was installed

in 1870 by the PRR in Trenton, New Jersey on the Camden and Amboy Division of the PRR. In 1881 the PRR installed the first large interlocking plant at its Broad Street Station in Philadelphia.

The first interlocking machines were operated by main force and connected to switches by means of pipe and to signals with wire. Subsequently, both switches and signals were connected by pipes. The first powered interlocking machine (1876) was pneumatic, followed by hydraulic (1882), and hydro-pneumatic (1883). The electro-hydro-pneumatic interlocking machine was invented in 1891 by the Union Switch & Signal Company (US&S), founded by George Westinghouse, the inventor of another apparatus critical to railway safety, the air-brake. On the US&S machine, track movements and switches were electrically indicated with lights on a track model mounted above the machine so that the operator could see the exact status of all the switches and signals in the interlocking system. Soon afterwards the hydraulic step was eliminated, resulting in the electro-pneumatic machine.

The operation of the electro-pneumatic machine began with the manual movement of the control lever which completed an electrical circuit; electricity charged an electromagnet, which opened a slide valve on a double acting cylinder at the switch, and the released compressed air moved the switch. Electricity also operated the air compressors. Semaphore signals were operated pneumatically at first, but subsequently semaphores were replaced by electrical automatic signals.

According to railroad engineer Everett Edgar King's 1921 text, Railway Signalling, The advantages of the electro-pneumatic over the mechanical system were:

1. one lever could operate many switches;

2. the part of the machine located in the second floor of the tower could be more compact, as the levers did not operate as true levers but rather as electrical switches, and therefore did not require as much room;

3. operation of the interlocking machine did not require as much physical exertion.

King described the operation of the US&S Model 14 electro-pneumatic machine (the model that was installed in the B&P tower) in the following terms:

> The operating levers are arranged in a row across the front of the machine and are numbered from left to right. Those turned upwards are switch levers and bear odd numbers, while those hanging vertically downwards are signal levers and bear even numbers. In its normal position the switch lever stands 30 degrees to the left of the vertical, and when reversed it stands to the right of the vertical, moving through an angle of 60 degrees. One switch lever may

control one, two and sometimes three switches, derails or movable point frogs. The signal lever points vertically downwards when normal; thrown 30 degrees to the left it serves to clear its corresponding signal or the selected one of a group of signals; thrown 30 degrees to the right it clears another given signal or selected one of a group, for train movement in the opposite direction. All signals that may be controlled by a given lever, however, must be those that govern movements over a common section of track.

The electro-mechanical interlocking machine was developed in 1909; with this system, electric motors, rather than pneumatics operated the switches. Although this set-up did away with air compressors and the piping necessary to deliver compressed air to the switches, a major disadvantage was the lack of durability; when several switches were moved concurrently, the electricity performed a great deal of work in a short time and there was abnormal resistance to the operation of motors and solenoids. Additionally, the electro-mechanical system was slower in operation than the electro-pneumatic. Consequently, electro-pneumatic systems were preferred for use in large terminals, in subway and elevated lines, and in other applications were there was frequent traffic.

The interlocking signal technology developed and refined in the United States between 1880 and 1940 was critically important to operation at the constantly expanding PRR facilities in Baltimore. Although the PRR station in Baltimore was known as "Union Station" because it served as a terminal for several PRR dominated lines, Baltimore still lacked a true central railroad station in the first decade of the twentieth century (the B&O main station remained Camden Station). Public demands for a central depot began to be voiced by a variety of individuals and groups, both independent and governmental. In 1906 Calvin W. Hendrick, chief engineer of the Sewer Commission, submitted plans for a union station at North Avenue and Jones Falls at a special meeting of his commission. Hendrick reported at the meeting that Mayor E. Clay Timanus was enthusiastically in favor of the proposed improvement. Hendrick's plans for the structure were not made public at that time.

In 1907 the Commission to Improve the Railroad Facilities of Baltimore was organized at a meeting at the Builders' Exchange. Expressing dissatisfaction with the way that the railroads had operated in the city, the Commission decided to keep the railroad companies in ignorance of the workings of the Commission and to appoint experts to devise a plan for the improvement of facilities in Baltimore. The railroads were to be forced to accept the plans, which were to be drawn up by the "best engineers." The Commission pressed for construction of a central station that would serve all the railroads operating in the city.

In 1908 Hendrick's plans for the proposed central depot were published in Baltimore newspapers. The plans portrayed a structure of mammoth design, with great arches and underground passages for trains and passengers and for the Jones Falls. At about this time agitation for the displacement of the old Union Station became even more insistent. When the PRR applied for a charter for new tracks, a City Council committee began a study of the matter. The proposal for a central depot was then submitted to the railroads. After

seven weeks without a reply, the committee announced that it was beginning to believe that perhaps the railroads did not favor the plan.

Possibly in an attempt to avoid the imposition of a plan unfavorable to its interests, the PRR decided to build a replacement for its 25-year-old Union Station. The PRR had been quietly improving its facilities in the vicinity of the station, including the construction of new interlocking towers between the station and the B&P and Union tunnels. In 1910 Union Station was demolished and a temporary structure was erected to serve until the new station was constructed. The design of Kenneth W. Murchison, of the prominent New York architectural firm of McKim, Mead, and White, called for an impressive Neoclassical building with its main entrance on Charles Street and access to tracks on the lower level. The structure was built by J. Henry Miller Company over a period of 19 months and cost $750,000. The new Union Station (it was not called Pennsylvania Station until 1926) opened its doors on September 15, 1911. At its inauguration, Gamble Latrobe, general agent and superintendent for the PRR in Baltimore, declared "There is not a better railroad station in Philadelphia, in New York, or in the country than this and it all belongs to Baltimore."

The PRR was not content simply with upgrading its passenger facilities. In 1914-15 the PRR built a large new freight house with supporting tracks on President Street and also a new coal pier on the water front at Canton. However, construction of the grand new PRR station and the improvement of PRR freight facilities did not quiet demands for a true union station that would include the B&O.

Earlier, in 1910, a group of prominent citizens had urged Mayor J. Barry Mahool to back the construction of a downtown station at Saratoga and North streets and the excavation of a tunnel from West Baltimore to the station. The call for such a new station followed the recommendations of Isham Randolph, an engineer employed by The Sun to make a study of the railroad situation. In August 1915 the Evening Sun reported that the mayor had sent to the City Planning Commission details of a $17,369,000 plan to build for the use of all railroads two city-owned tunnels running from Franklin to Biddle streets and a Grand Union Station located south of Union Station. Although Baltimore and Pittsburgh capitalists were ready to furnish funding and Baltimore City was prepared to guarantee the necessary bonds, the project was never carried out. In the 1920s the idea of a central depot resurfaced briefly. In 1926 Richard H. Edmonds, editor of Manufacturers' Record stated "The greatest work the association [Baltimore Association of Commerce] could do for Baltimore would be to obtain a union station for the city." In 1927, Bernard L. Crozier, Baltimore City Chief Engineer, again proposed the construction of the station, but his suggestion was received coolly by the railroads. In the same year the City Plan Commission recommended that a committee be established to study the possibility of a central depot in the Jones Falls Valley.

Faced with public demands for better, more centralized rail service, American railroads during the early twentieth century turned to electrification as well as consolidation of terminal facilities. By the late 1920s electric locomotives had become a proven form of motive power. The advantages of the electric locomotive over the steam locomotive were

becoming increasingly apparent, especially to cities that had been plagued by the noxious smoke spewed forth by steam locomotives. Tunnels such as those found in Baltimore aggravated the pollution created by the burning of bituminous coal. Aside from the improvement in public relations brought about by converting from steam to electricity, railroads had discovered that electric locomotives were capable of hauling greater tonnage than their steam counterparts. Greater tonnage meant more traffic, and hence, greater profits. The PRR experience with electric locomotives began in 1902 with the extension of the PRR into New York City by tunnels under the North River. At that time a design was settled upon that was to remain in operation until 1933. In the 1920s the PRR made improvements in its electric locomotives, the most notable locomotive being the Class L-5, which had a starting tractive force of approximately 54,000 pounds. The L-5, originally designed for freight service, was also used to pull passenger trains. Subsequently, as electrification was extended beyond terminal areas, Class O-1 and P-5 locomotives were to be developed to provide higher speeds.

By 1928 the PRR had resolved to electrify its line from New York to Washington. In order to achieve electrification of its line in Baltimore, authorization by the City of Baltimore was needed. Accordingly, the PRR proposed a series of ordinances to the City Council in which it sought authorization to build additional tracks, construct new tunnels, and electrify its lines through Baltimore. Mayor Broening appointed a committee (consisting of Alexander Armstrong, John Alocke, J.E. Greiner, and J.B. Whitehead) to investigate the proposed ordinances. As a result of the committee's findings, the City generally agreed with the proposals but refused to permit the PRR to run 132,000-volt transmission lines through the city unless they were buried. The main thrust of Baltimore's objection to overhead lines appears to have been on aesthetic grounds, although some fear was expressed that overhead transmission lines could be dangerous. The PRR was not pleased by this stipulation; all of its experience in electrification (including the 1928 electrification of Philadelphia through Wilmington) had been with overhead transmission lines. Having encountered similar objections in the District of Columbia, in 1930 PRR conceded the issue after months of argument. The PRR proposals, as modified by the City Council, became ordinances 746, 747, and 748, which were passed by the council and approved by Broening in 1929.

1929 was not a propitious year to begin a project of this magnitude. Even the PRR faltered under the onslaught of the Great Depression. Work on the New York to Washington electrification project was begun in 1929 but the PRR experienced difficulties in raising the capital needed to keep the work proceeding at the required pace. In 1932 the PRR sought assistance from the recently created Reconstruction Finance Corporation, but found that the 6 percent interest rate was unduly burdensome. Early in 1934 the PRR obtained from the Public Works Administration a loan (at 4 percent interest) of $45,000,000 to complete the electrification work, $15,000,000 for new locomotives, $17,000,000 for new freight cars, and $3,650,000 for the purchase of 100,000 tons of new rail. Work, which had lagged for some time due to funding problems, now could resume full speed. By 1934 11,200 men were involved on the project, all of whom were PRR employees who had been on furlough.

The electrification of the line required the following improvements in Baltimore:

1. erecting catenary towers and laying of underground transmission lines (in accordance with the City Council's requirements) that were insulated by immersing the cables in large pipes filled with oil under pressure;

2. implementing numerous track changes and improvements, necessitating the flattening out of a swing of the Jones Falls by constructing a 400-foot concrete retaining wall;

3. reducing track grades and widening track curvatures;

4. constructing a double-track tunnel (3,403-foot-long) paralleling the Union Tunnel;

5. stabilizing and waterproofing of the B&P Tunnel;

6. extending and altering a number of bridges;

7. lengthening platforms at Penn Station to accommodate longer trains as well as lowering of tracks and platforms - the number of station tracks remained unchanged;

8. replacing semaphores with position-light signals;

9. implementing new interlocking arrangements in the vicinity of Pennsylvania (formerly Union) Station to allow the safe and expeditious routing of the anticipated greater volume of traffic.

The improvements in Baltimore, exclusive of the electrification, cost approximately $14,100,000, and were planned and carried out under the general direction of T.J. Skillman, chief engineer of the PRR, and W.B. Wood, engineer of Baltimore improvements. Work was essentially completed in Baltimore by January 1935 and through electric passenger train service was inaugurated between New York and Washington on February 10, 1935. Eleotrified freight service began a few months later on May 20. It should be noted that trains became longer after the implementation of electrified service; the newly (1934) introduced GG-1 electrical locomotives were capable of hauling substantially greater tonnage than the steam locomotives that they replaced. Boasting a continuous 4,620 horsepower, the GG-1 was capable of moving a passenger train on the open track at more than 100 miles per hour and a freight train at ninety miles per hour. As a result, the PRR's "Congressional Limited" was able to cut its Washington to New York trip from 255 to 225 minutes, with an average speed of nearly a mile a minute for the 225 mile run. PRR expectations of greater volumes of traffic through Baltimore were not disappointed; two years later, in 1937, sixty-six trains passed the B&P Interlocking Tower in a four-hour period.

Aside from comparatively minor improvements, the Baltimore facilities remained largely unchanged in subsequent years. In 1959 the B&P and Union tunnels were altered to accommodate piggyback traffic (the carrying of truck trailers on flat cars). Modifications of the tunnels necessitated $300,000 of improvements that included the installation of a "gauntlet track" at one point in the B&P Tunnel. The gauntlet track was a pair of rails laid 17" closer to the center of a tunnel than one of the two regular tracks. Piggyback trains were switched to this extra track as they approached the curve of the tunnel and followed the track, straddling the inside rail of the adjoining regular track, for a distance of 928' before switching back to the regular track beyond the curve. The final notable change in the operation of railroad facilities in the vicinity of Pennsylvania Station occurred in the 1980s, when centralized traffic control was introduced as part of the Federal Railroad Administration's Northeast Corridor Improvement Project (NECIP). With centralized traffic control, controllers in Philadelphia assumed the responsibilities of routing rail traffic through the numerous switches of the railroad complex.

The history of the B&P Interlocking Tower and the machines that it housed reflects the historical development of PRR facilities in Baltimore. Information provided by Robert L. Williams, railroad historian and operator at the B&P and Union towers between 1981 and 1988, indicates that the present B&P Interlocking Tower had three predecessors. The first structure, built in 1873, was a small (4' x 6'), one-story, wood building that was close to or under the current Charles Street. The building was equipped with a telegraph machine, a desk and a clock, and was manned by a train director (later known as the dispatcher). The train director directed by hand signals the switchmen, who manually threw the switches necessary for train routing. The area of responsibility for the tower was the entire station complex.

Increasing rail traffic through the area caused this single structure to be replaced in 1877 by two towers, the first B&P and Union Interlocking Towers. Located farther west than the old tower, the B&P tower's area of responsibility extended from the station to beyond the B&P Tunnel; the Union Interlocking Tower handled the area extending from the station to the north. The B&P structure was a two-story, octagonal wood tower, following NC standard plans of the nineteenth century. It was equipped at the time of its construction with a 20-lever Saxby and Farmer interlocking machine. John Elfreth Watkins's 1896 history of the PRR indicates that this machine was replaced by a 54-lever mechanical interlocking machine in 1886 "to protect the switches south of the station at the junction of the Union Railroad and North Central's tracks."

Apparently, the capacity of the 54-lever machine was not adequate to the increasing traffic in the area (mechanical interlockings could control up to 1,200' of track), and in 1891 the machine was replaced by a 74-lever electro-pneumatic machine. This machine, made by US&S, was state-of-the-art; Railway World reported that the machine represented "the latest improvements of the Union Switch & Signal Company." The new machine, which was responsible for a five-minute reduction in travel time between New York and Washington, controlled thirty-three switches, five movable frog points, and semaphore signals placed on

bridges over the tracks. The Railway World article also briefly described the operation of the interlocking machine:

> One telegraph operator and two levermen were constantly in the tower which was of two stories and contained seventy-four switch and signal levers. By an ingenious arrangement the operator in charge controls all the switches which makes it impossible for the levermen to open a switch until the operator knows the tunnel tracks are clear.

The telegraph equipment for the tower was provided by the Western Union Telegraph Company. The B&P tower's telegraphic prefix was "GU" and the Union tower's was "CS"; in addition to alerting tower operators of incoming communications, these prefixes were frequently used to identify the towers on PRR maps.

The 1877 B&P tower was replaced in February 1895 by a two-story, wood structure equipped with a 104-lever Saxby and Farmer interlocking machine. Concurrently, dwarf, mechanical semaphore signals on a block-signalling system were introduced in the area. This 1895 tower was the first B&P Interlocking Tower to appear on Sanborn insurance maps; the 1901 Sanborn map shows a two-story "interlocking signal house" one-half block north of the location of the present tower. Its proportions were narrower than the present tower. This tower was to remain in service as an interlocking tower until the construction of the present tower in 1911, and served thereafter as the headquarters of the dispatcher until his office was moved three years later to the second floor of Union Station. The 1914 Sanborn map shows a one-story "Tool House" at the same location having the same proportions as the building identified as the interlocking signal house on the 1901 map. PRR mapping of the area indicates that the building was demolished in 1915, although the "Tool House" was inaccurately retained on Sanborn maps through 1944.

Increasing rail traffic likely caused the PRR to plan the construction of yet another replacement of the B&P tower by 1906. A 1906 Bromley insurance map reveals two structures labelled "Tower Ho." in the area; one of the buildings, located at roughly the same location as the "interlocking signal house" shown on the 1901 Sanborn, is of frame construction; the other is located farther south, at the same location as the present tower. The Bromley map, however, shows what was anticipated, but not yet built; PRR annual reports indicate that the present tower was officially opened on September 1, 1911. The 1914 Sanborn map showed this B&P tower as a two-story "Switch Tower," located at the site and having the same proportions as the present B&P tower. The map indicates that the bottom story of the tower was of concrete or similar construction and that the second story was of frame construction. The B&P tower was nearly identical to the Union tower which was built at the same time; the principal difference was that the Union tower featured a bay on both its northeast and southwest facades, whereas the B&P tower was built with a bay only on its northeast facade. A 1913 article in The Signal Engineer detailed the construction of both towers:

> The towers are of fireproof construction, two stories high over a basement. The foundations are of concrete, and the floors are all reinforced concrete. The walls of the first story are constructed of fire tile covered both inside and out with specially prepared plaster. The second story is made up of a framework, copper covered. The roofs are covered with a Spanish red tile.

Physical examination of the present B&P tower verifies this description except for the statement that the foundations were concrete; the foundations of the B&P tower are of brick.

The B&P Interlocking Tower, although built primarily in response to a utilitarian need, is an attractive building constructed with far more attention to aesthetics than was required by its function as an interlocking tower. It was not unusual for interlocking and signal towers of the period to be constructed with more than cursory attention to their appearance. In his 1891 text, Buildings and Structures of American Railroads, Walter Berg, Principal Assistant Engineer of the Lehigh Valley Railroad, included a number of elaborate designs for interlocking and signal towers, noting that such designs were "well adapted for crossings in towns and at important thoroughfares where the neat appearance of all railroad structures is considered desirable." The B&P tower's flared, hipped tile roof recalls the Oriental influence of the signal towers that the NC had built in the later nineteenth century and the careful, Craftsman-style detailing of its roof and bay brackets suggest that the building served more than a utilitarian purpose. In addition to ensuring the safe and expeditious routing of traffic in the area, the B&P tower, like its sister Union tower, heralded the passenger's arrival at Union Station, PRR's central depot in Baltimore. Although the style of the tower does not match that of Pennsylvania Station, its pleasing appearance was doubtless regarded as a fine introduction to the PRR's facilities in Baltimore.

Aesthetics notwithstanding, the real impetus for the construction of the new B&P and Union towers was to expedite rail traffic in the Union Station area. The volume and complexity of this traffic was described in the 1913 Signal Engineer article:

> The Union Station at Baltimore is used by all trains entering or leaving that city over the Northern Central, Philadelphia, Baltimore & Washington, Western Maryland and Baltimore & Sparrows Point Railways. There are approximately 300 passenger train movements in and out of the station every 24 hours. The two interlocking plants [B&P and Union] also handle all the shifting movements for making up trains, through and local freight movements over the Northern Central and the Philadelphia, Baltimore & Washington, which, added to the passenger movement, make a conservative estimate of 650 train movements every 24 hours.

To accommodate this increased traffic, an entirely new arrangement of tracks was laid in the area and new interlocking machines were installed in the B&P and Union towers at the time of their construction in 1911. A US&S Model 14 electro-pneumatic interlocking machine with 107 levers was installed in the B&P tower and a 95-lever machine in the Union tower. Of the B&P machine's 107 levers, ninety-seven working levers controlled forty top-

post signals, thirty-four dwarf signals, eighty-seven switch and block movements and the lock and block set up on fourteen tracks between the two towers. The Union tower had eighty-one working levers. A 1912 article in Railway Age Gazette reported that automatic signals were soon to be installed on the line from the B&P junction to the District of Columbia, but it appears that the new signals were to be integrated into the already existing interlocking system. In 1914, a US&S catalog stated that there were four interlocking plants (B&P, Fulton, Union, and Biddle Street) regulating the Baltimore Terminal and its approaches; all machines were US&S electro-pneumatic and totalled 254 levers. As in the case of the B&P machine, not all of these levers were operational; the machines had enough free levers to meet anticipated future requirements. Such design foresight proved appropriate; the US&S Model 14 interlocking machines installed at the B&P and Union towers successfully met their respective requirements for over seventy-five years.

The interlocking machine and its connections took up the majority of space in the two stories and basement of the B&P tower. The single-room second floor was dominated by the machine's console and a large mechanical track model board which depicted the track arrangements controlled by the tower. The single-room first story was equipped with a work-bench, tool cabinets and lockers. Located in the center of the room were a four-sided indicator rack and the main terminal boards. All wires leading to the outside were terminaled and labelled on these boards. The basement contained a storage battery, a transformer vault and a steam heating plant. Encased in conduits leading from the first-story relays, electrical wires passed through the basement's northeast wall and were led underground to the signals and switches.

During the 1929-1935 improvements accompanying the electrification of the PRR line, power substations were erected several yards from the northwest and southeast ends of the tower. The B&P tower's 1910 US&S machine was retained (of its 107 levers, eighty were used in 1935), as was the Union Tower machine (ninety-five levers, seventy-seven in use), but both machines were given entirely new hook ups. The changes at the B&P tower were complex and had to be made in fifteen distinct steps, involving "numerous wiring and pipe changes throughout the interlockings in order to keep all switches and signals in service under power operation and control." Most of the relays on the first floor were replaced, but a few of the 1910 relays were retained and continued in operation until the tower closed. At this time the B&P Interlocking Tower controlled the Mt. Royal Coach Yard, the A, B, and C tracks at Pennsylvania Station, the B&P Freight Yard, and also the short B&O "high line" to the Mt. Vernon Produce Terminal. A new 49-lever electro-pneumatic interlocking machine was installed at Gwynn's Run and, at the same time, the old interlocking tower at Biddle Street with its 19-lever machine was abandoned; its responsibilities were assigned to the Union Interlocking Tower.

Apparently one of the improvements to the B&P tower at this time was the installation of a lavatory in the northwest corner of the second story; before this improvement a nearby outhouse was used. Historical photographs indicate that the current exterior stairway was added to the southwest facade of the B&P tower between 1934 and 1943. At this time a

second-story entrance was cut into the facade and the interior stairway in the southeast corner was removed.

In 1937, a Baltimore Sun article described in detail the operation of the B&P Interlocking Tower and how it interacted with overall train dispatching in the Pennsylvania Station area. Overall control for traffic routing was centered in the second floor of Penn Station, where the train dispatchers' office and the power room were located.

The train dispatchers' office was operated by two dispatchers and subordinates concerned with the make-up and clocking of freight and passenger trains. The two dispatchers, sitting opposite each other at a low, sloping desk, wore earphones and speaking tubes on their chests. By means of the speaking tubes the dispatchers gave orders to the men who staffed the B&P and other interlocking towers.

The power room was staffed by men who energized and de-energized tracks. Scrutinizing lights on a large electrified wall chart of the track layout, it was the responsibility of these men to control the electrification of the layout so that tracks could be repaired safely. It was to these men that the interlocking tower reported when it was necessary to repair a section of track under its jurisdiction.

The interlocking tower was operated by four men: the operator, two levermen, and the maintainer. The supervisor of tower operations was the operator, who sat at a desk placed before the bay window and equipped with phones and clocking sheets. The operator clocked trains as they passed, communicated with operators at interlocking stations above and below his own, and kept in constant contact with the dispatchers at Pennsylvania Station and the engineers of the trains.

It was the levermen who were responsible for the actual operation of the levers of the interlocking machine, which extended two-thirds of the length of the B&P tower. On the front of the 107-lever machine were 100 levers (81 working levers, 19 spare) and seven spare spaces for levers should they be required. Located behind the machine, and extending the full length of the machine, was a track chart similar to the chart in the power room, but representing only those tracks controlled from the B&P tower. The numbers on the chart corresponded to the numbers on the switch levers on the interlocking machine, and above each number was a light which lit up when the switch was thrown. Above each number on the machine was a glass container; when an L or an R flashed in the container, the leverman would turn the switch accordingly. Then the corresponding number was illuminated and remained on until the train had passed that switch. As the train passed over the switch, the signal for the next switch was displayed, which the leverman threw and the train would proceed. By means of the levers, the levermen controlled fifty-nine signals, fifty-four switches, six multiple position frogs, four derails, and one electrical switch lock.

The fourth member of the tower's crew was the maintainer, who dealt primarily with the machinery in the first story and basement of the tower. He repaired the numerous

electrical relays located on the first floor of the tower and made sure that they were correctly wired to the pneumatic devices at the switches.

The Baltimore Sun article pointed out that the B&P tower was "an especially difficult tower, not just because of the tunnels, but also because at the station proper the road fans out into fourteen tracks." The article also stated that "the crew in the north [Union] tower have an easier time of it than the men in the south [B&P] tower who must handle all Washington traffic through a single tunnel," as compared with the Union tower's two tunnels. However, the article reassured the potentially nervous passenger that:

> ...the machine is so contrived that no two trains can be put in the same block simultaneously, and alongside its mechanical perfections stands the leverman who checks the chart continuously. It is next to impossible for that machine to make a mistake, and as no train proceeds without clear signals, should the machine fail to function, the train would stop until the signals became clear.

By the 1960s the increased use of automobiles and trucks had reduced the amount of rail traffic passing through the Pennsylvania Station complex and led to a down-sizing of the interlocking responsibilities of the B&P and other Interlocking Towers. The elimination of the tower as a functioning structure came about in the 1980s as a result of the Federal Railroad Administration's Northeast Corridor Improvement Project (NECIP), which centralized all traffic control in Philadelphia. On July 14, 1988 the last train passed over the tracks controlled by the B&P Interlocking Tower. Since that time, a long, one-story, windowless structure has been located several yards from the B&P tower's southwest facade . Should the Philadelphia-based centralized traffic control system fail for any reason, railroad staff in this auxiliary interlocking structure can control the movement of trains over the track, switches and sidings that were once the responsibility of the now-vacant B&P tower.

The history of the B&P Interlocking Tower and its machinery reflects the development of PRR facilities in Baltimore in the first half of the twentieth century. The primary function of the building was utilitarian; the B&P tower, like its sister tower at Union Junction, served the critical function of coordinating the routing of both passenger and freight trains through the Union (Pennsylvania) Station complex, a task which increased in complexity as the PRR electrified its tracks in the 1930s. The localized control of tracks which the B&P tower and its machinery exemplified is now a closed chapter in railroad technology; the function of such interlocking towers has been superseded by the advent of centralized traffic control. In addition to its utilitarian function, the B&P tower was attractively designed and detailed in a deliberate effort to please Baltimoreans and the train-riding public. The tower visually announced one's arrival at the PRR's central depot in Baltimore, thus reinforcing the general impression of prosperity and technological accomplishment provided by Pennsylvania Station.

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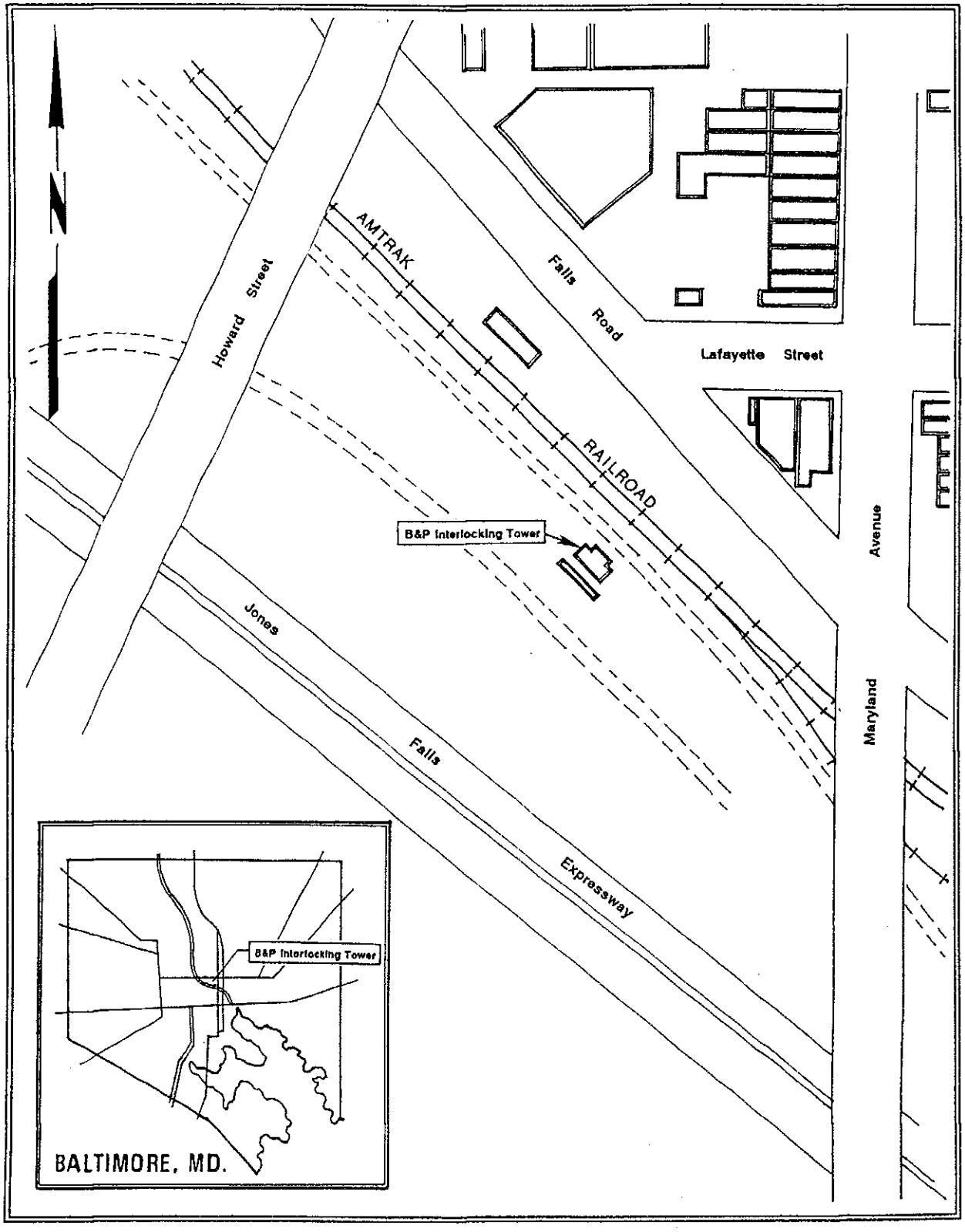
Project Location Map

Site Plan


N
Howard Street
AMTRAK
RAILROAD
Falls Road
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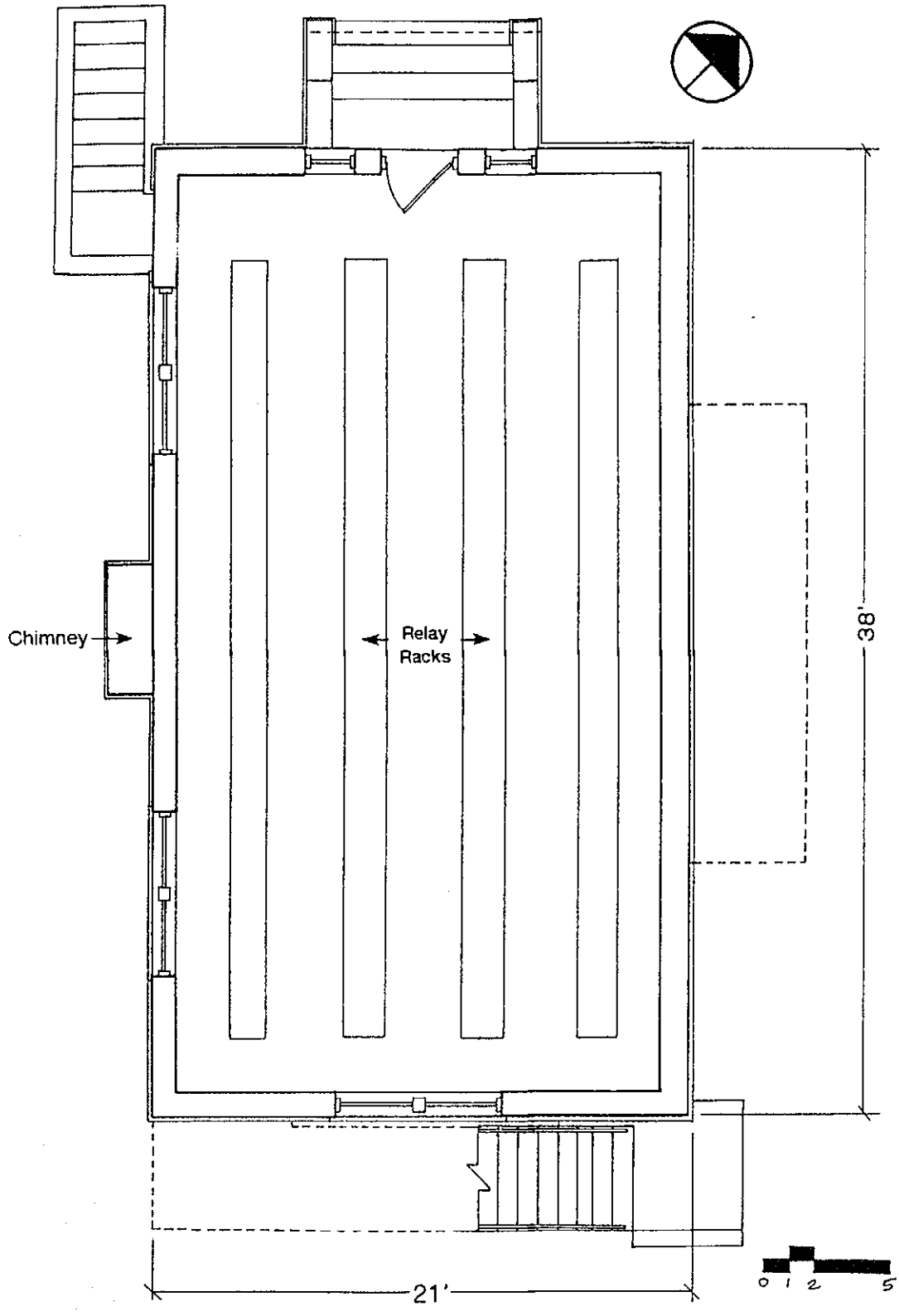
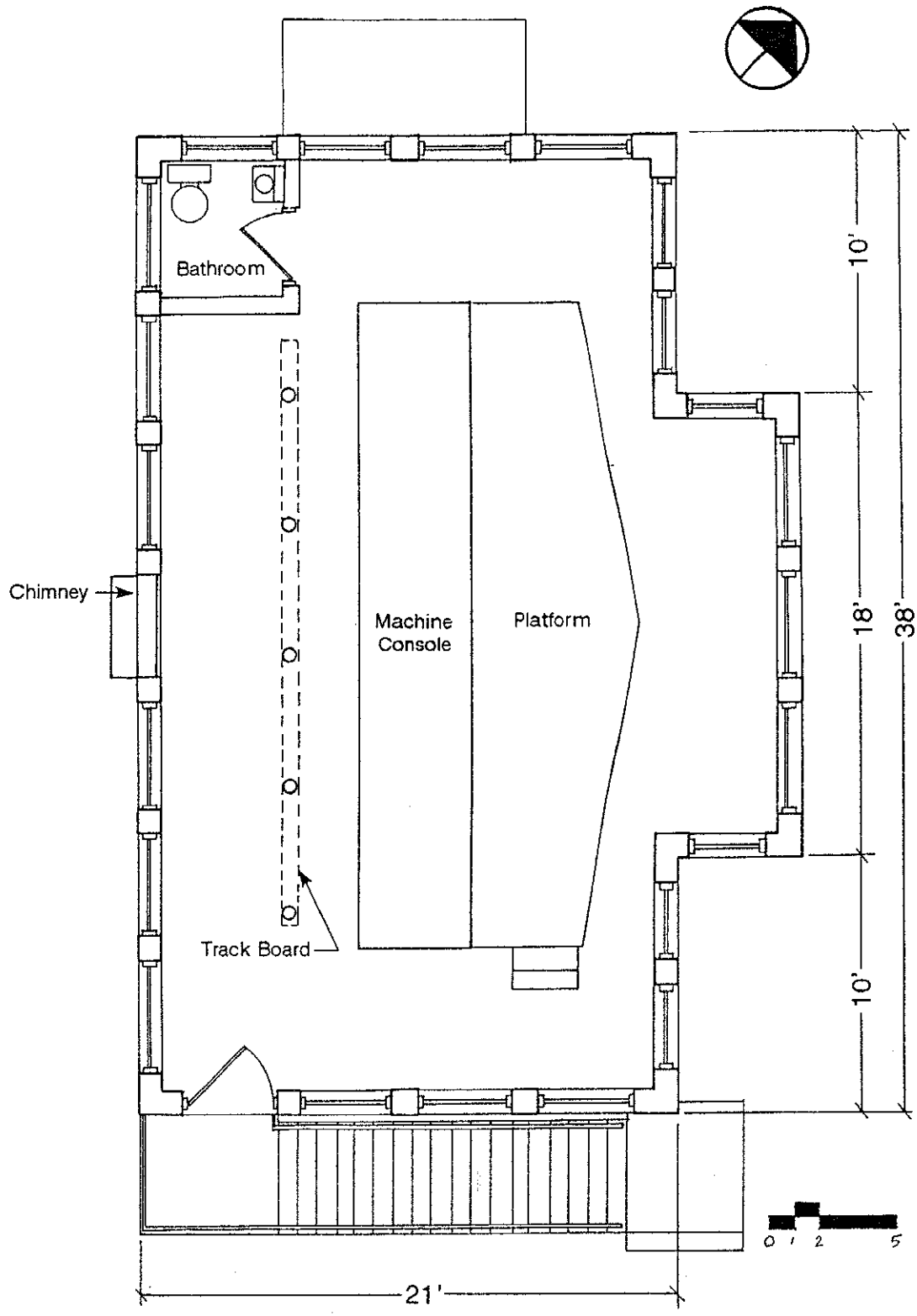
Maryland Avenue
B&P Interlocking Tower
Jones Falls Expressway
B&P Interlocking Tower
BALTIMORE, MD.

First Floor Plan



BALTIMORE & POTOMAC INTERLOCKING TOWER
HAER NO. MD- 163 (Page 25)
Second Floor Plan



Basement Plan